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- (3) The locus of a point which lies at some constant distance from the curve on its inner normal must be such that it is also the locus of a point fixed on a bar of some simple linkage. In estimating the value of the word "simple" pivoted bars are preferred to slides and the total number should be as small as possible.

Condition (3) is needed to enable a cylinder to be ground accurately to the curve.

CALCULUS.

417. Proposed by H. S. UHLER, Yale University.

To the degree of approximation indicated, show that

$$(\sqrt{-1})^{\sqrt{-1}} = 0.207,879,576,351.$$

418. Proposed by B. F. FINKEL, Drury College.

A rectangular tract of land is to be bought for the purpose of laying out a quarter-mile track with straightaway sides and semicircular ends. In addition a strip 35 yards wide along each straightaway is to be bought for grandstands, training quarters, etc. If the land costs \$200 an acre, what will be the least possible cost of the land required?

GRANVILLE's *Differential and Integral Calculus*, p. 116.

Is there anything wrong with this problem? Explain the contradiction involved in the solution.

MECHANICS.

334. Proposed by HORACE OLSON, Chicago, Illinois.

A particle of elasticity e is projected with a velocity v at an angle ϕ with a plane inclined to the horizontal at an angle ψ ; its plane of motion is perpendicular to the inclined plane. Show that after $2v \sin \phi / g(1 - e) \cos \psi$ seconds it will cease to rebound and will move along the plane with an initial velocity $v \cos \phi - 2v \sin \phi \tan \psi / (1 - e)$ and a uniform acceleration, $g \sin \psi$, down the plane.

(This problem is a generalization of problem 289 in *Mechanics*, which appeared in the March, 1914, issue of the MONTHLY.)

335. Proposed by HAROLD T. DAVIS, Colorado Springs, Colorado.

A heavy particle is projected upwards with a velocity V in a medium resisting as the n th power of the velocity. Prove that the elevation of the particle when the velocity downwards is V is equal to LT where L is the limiting velocity and T is the time in which the particle falling from rest in the medium will acquire a velocity V^2/L .

NUMBER THEORY.

254. Proposed by HORACE OLSON, Chicago, Illinois.

Find three integers, x , y , and z , such that $x^2 + y^2$, $x^2 + z^2$, $y^2 + z^2$, and $x^2 + y^2 + z^2$ are all perfect squares.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

456. Proposed by PAUL CAPRON, U. S. Naval Academy.

If

$$S_{i,n} = \sum_{k=1}^{k=n-i+1} \frac{(i+k-1)!}{(k-1)!},$$

show that $S_{i,n}$ is equal to $1/(i+1)$ times the last term of $S_{i+1,n+1}$; as, for instance, that

$$S_{1,n} = 1 + 2 + \cdots + n = \frac{n}{2}(n+1),$$

that

$$S_{2,n} = 1 \cdot 2 + 2 \cdot 3 + \cdots + n(n+1) = \frac{1}{3}(n-1)n(n+1),$$

etc.